

Dental emergencies at sea: A study in the French maritime TeleMedical Assistance Service

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Abstract

Introduction: The aim of the study was to assess the frequency, features and management of dental emergencies at sea in France.

Methods: A descriptive study was carried out by retrospectively examining medical records of patients who were assisted by the French maritime TeleMedical Assistance Service (TMAS) from 2012 to 2016. Data were ranked in different categories: socio-demographic data, diagnosis, prescription, and monitoring or treatment prescribed.

Results: The TMAS recorded 9122 medical files for all medical emergencies. Among these medical records 135 concerned oral diseases. The main causes for dental emergencies are dental abscess (51.8%), tooth decay (33.3%), and dental fracture (8.9%). Even where teledentistry is validated for remote screening and oral lesion diagnosis, management of dental emergencies mostly requires a dental procedure. On board, without special equipment and/or specifically trained healthcare workers, this management often results in the prescription of medicine.

Discussion: The *International Medical Guide for Ships* published by the World Health Organization could be updated to suit the latest recommendations of dental emergency management. This could facilitate the addition of a medical act to dental management, resulting in more effective treatment. Furthermore, simple and specific equipment could be added to the medical supplies.

Keywords

Dental health, maritime health, telemedicine, emergency management

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Introduction

Every day there are many civil vessels (merchant ships, yachts and fishing boats) at sea. Dental problems and oral pathologies seem to be a common health problem of seafarers.^{1,2} Oral health condition of seamen and fishermen are relatively poor (high tooth decay prevalence and poor periodontal health).^{3,4} Crews tend to eat at irregular times and use excessive amounts of snacks including sugars and fermentable carbohydrates (main risk factors of tooth decay).^{2,3} More than 56% of seamen consume tobacco and 11% consume alcohol on board.² Only 40% of the sailors brush their teeth twice a day and only 60% of them have all their teeth.² A 12-month Norwegian study of the crew of three passenger vessels (8888 crew members) shows that a patient was referred to a dentist onshore every 7 to 10 days.⁵ Furthermore, 50 to 70% of the patients

referred to a specialist onshore were for oral diseases. Another study shows that 7% of infections on board are dental infections.⁶ A dental emergency is the first reason why sailors are referred to a specialist onshore.^{5–7} Sailors may remain at sea for several days or weeks with short periods onshore. Thus, access to dental care

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may be limited for crew members, including a lack of both regular check ups and dental treatment.¹

Dental emergencies happen in hostile and isolated environments (limited access to care, lack of equipment and often a scarcity of care workers).⁸ Directive 92/29/EEC of the European Economic Community (1992) indicates that a physician has to be aboard vessels with at least 100 crew members who remain at sea more than three days.⁹ Thus, there are usually no physicians on board and there are never any dentists. The captain (or a crew member in charge of medical assistance on board) should have completed special medical training. However, they are often not able to take care of a patient without help.⁹ Telemedicine provides medical assistance to ships at sea⁷ via radio or satellite communication.¹⁰ In the case of a health problem on board, the captain or his/her delegate has to triage and send the case information to the Telemedical Maritime Assistance Service (TMAS). TMAS comprises physicians specially trained in emergency response, in remote medical assistance at sea and in maritime routine. No dentist work in the French TMAS. TMAS is part of the emergency medicine centre of the University Hospital of Toulouse (France). This service provides telemedical consultation and assistance to all civil ships regardless of origin and in all the seas worldwide. There are only few studies focused on dental emergencies at sea and their management. A retrospective study was conducted on the French TMAS. The aim of this study was to assess the frequency, features and management of dental emergencies faced by the French TMAS at sea.

Materials and methods

Data collection

TMAS physicians (emergency physicians) collected medical records concerning dental emergencies between 2012 and 2016 in the French TMAS (Toulouse, France). TMAS physicians are able to request expert advice from dentists of the University Hospital of Toulouse if necessary. For the study, a single TMAS physician selected the dental cases. The patient's age, sex, nationality, diagnosis and the care given (prescription, dental care, monitoring) were indicated in these medical records, as well as the type of ship the patient was on.

The data were anonymised and compiled without personal names or personal identification. The local ethics committee of the University Hospital of Toulouse approved the study.

Data ranking

Two dentists from the dental department of the University Hospital of Brest (France), specially trained in dental emergencies management, independently ranked the data in different categories (Figure 1).

- Diagnosis: tooth abscess, decay, traumatism, sinusitis, gingivitis or periodontal disease.
- Socio-demographic data (age, sex, nationality and type of ship).
- Prescription: antibiotic treatments (Amoxicillin, Amoxicillin/Clavulanic acid, Metronidazole, Azithromycin, Ofloxacin), analgesic drugs (paracetamol, Tramadol), non-steroidal anti-inflammatory drugs (Ketoprofen), mouth rinses (Hexetidine, Chlorexidine-Chlorobutanol). Drug prescriptions depend on the availability of medical supplies on board.
- Monitoring or treatment prescribed: temperature monitoring, clinical appearance, digital photography for further information.

In the case of discrepancies, the ranking was achieved through a discussion between the two dentists. To study the management of dental emergencies among TMAS, the different prescriptions were ranked according to the main diagnosis.

Results

Characterisation of dental emergencies

Between 2012 and 2016, TMAS recorded 9122 medical records for all types of medical emergencies. On average, this corresponds to 1824.4 medical records per year. Among these 9122 medical records, 135 concerned oral diseases, with an average of 27 medical records for oral emergency per year. Dental aetiology constitutes on average 1.48% of all medical records (Table 1). Regarding oral disease and dental emergencies, each case was the subject of a single and unique call.

Socio-demographic data

Of the 135 medical records, 131 related to men and 4 concerned women. Patients' ages ranged between 7 and 62, with a mean age of 39. Twenty nationalities were represented: the highest percentage comprised the French followed by Filipinos and Romanians (Table 2). Sixty-one of the patients (45.2%) were on board cargo ships (container ship, oil tanker, bulk carrier, roll-on, gas carrier), 48 (35.6%) on specialised vessels (cable-layer,

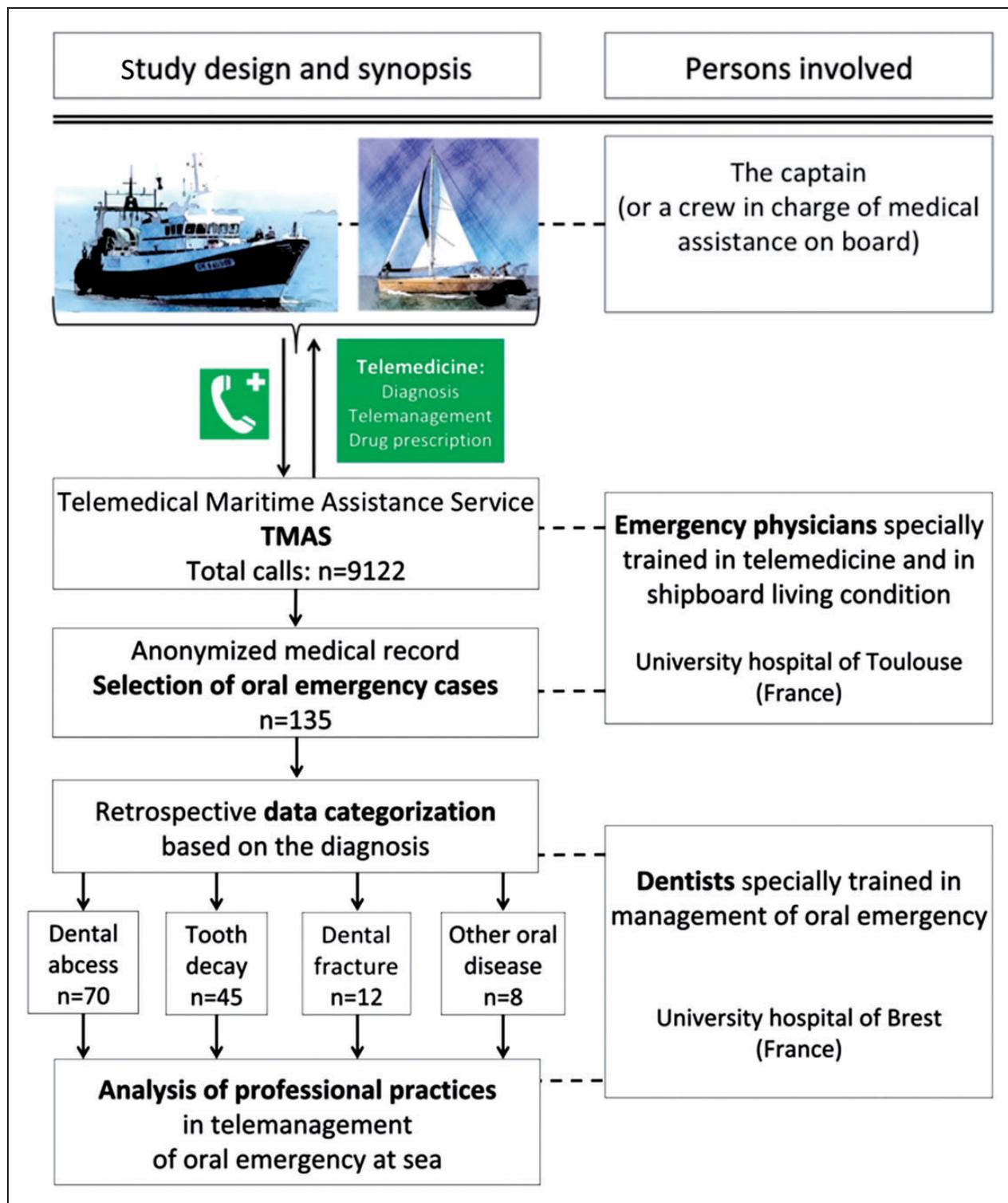


Figure 1. Flow chart, synopsis and persons involved at each step of the study.

supply, oceanographic vessel), 23 (17%) on fishing boats (trawler, tuna seiner, longliner), 1 (0.7%) on liners, 1 (0.7%) on racing sail boats and 1 (0.7%) on sailing ships.

Diagnosis

Of the 135 dental emergencies, 70 concerned dental abscess, 45 decay, 12 dental fracture and 3 presented with gingivitis or periodontal diseases. A few rare

Table 1. Medical records concerning oral disease per year.

Year	Number of medical records, <i>n</i>	Number of medical records concerning oral disease, <i>n</i> (%)
2012	1834	31 (1.7)
2013	1819	31 (1.7)
2014	1765	25 (1.4)
2015	1797	32 (1.8)
2016	1907	16 (0.8)
Mean value/year	1824.4	27 (1.48)
Total	9122	135 (1.48)

Table 2. Patients with oral disease based on their nationality.

Nationality	Patients with oral disease, <i>n</i> (%)
French	62 (46)
Filipino	33 (25)
Romanian	17 (13)
Other	23 (17)

Table 3. Medical records for each diagnosis.

Diagnosis	Number of medical records, <i>n</i> (%)	
Dental abscess	70	(51.8)
Tooth decay	45	(33.3)
Dental fracture	12	(8.9)
Gingivitis or periodontal diseases	3	(2.2)
Ulcerative and erosive lesions of the oral mucosa	2	(1.5)
Erysipelas	2	(1.5)
Sinusitis	1	(0.7)

Table 4. Prescription and dental abscess.

Antibiotics	Number of prescriptions, <i>n</i> (%)		Antalgic	Number of prescriptions, <i>n</i> (%)	
Amoxicillin/Clavulanic acid	50	(71.4)	Tramadol and paracetamol	31	(44.3)
Amoxicillin and Metronidazole	2	(2.9)	Paracetamol only	15	(21.4)
Amoxicillin/Clavulanic acid and Metronidazole	1	(1.4)	Ketoprofen and paracetamol	9	(12.9)
Only Amoxicillin	1	(1.4)	Ketoprofen and paracetamol and Tramadol	5	(7.1)
Only Metronidazole	1	(1.4)	Tramadol only	2	(2.9)
No antibiotic	15	(21.4)	Ketoprofen only	1	(1.4)
			No antalgic	7	(10)

diseases were also diagnosed (erysipelas, intra-oral ulcerative and erosive lesions, sinusitis) (Table 3).

Prescription

Prescriptions and abscess

Antibiotics and abscess. Among the 70 dental abscesses, 55 patients received antibiotics. Fifty patients received Amoxicillin/Clavulanic acid, one patient Metronidazole only, and the other patients Amoxicillin alone or coupled with a second antibiotic (Table 4).

Non-steroidal anti-inflammatory drug (NSAID) and abscess. Concerning dental abscess diagnosis, 15 patients were prescribed non-steroidal anti-inflammatory drugs (NSAIDs) e.g. Ketoprofen. Of these 15 prescriptions only one was not antibiotics.

Analgesics and abscess. Of the 70 abscesses, 62 patients received analgesic medication including 38 prescriptions of weak opioid analgesics (Tramadol), and 60 prescriptions of nonopioid analgesics (paracetamol). Five prescriptions of weak opioid analgesics and 14 prescriptions of nonopioid analgesics were associated with NSAID.

Mouthwash and abscess. Among these 70 abscesses there were 29 prescriptions for mouthwashes (15 Chlorhexidine-Chlorobutanol and 14 Hexetidine).

Prescriptions and tooth decay

Antibiotics and tooth decay. Among the 45 cases of decay, there were 15 prescriptions of antibiotics (Table 5).

Antalgics and tooth decay. Among the 45 cases of decay, 44 patients received analgesic medication including 29 prescriptions of weak opioid analgesics and 43 prescriptions of nonopioid analgesics. NSAID was

Table 5. Prescription and tooth decay.

Antibiotic	Number of prescriptions, n (%)		Antalgsics	Number of prescriptions, n (%)	
Amoxicillin/Clavulanic acid	13	(28.9)	Paracetamol and Tramadol	18	(40)
Amoxicillin	1	(2.2)	Ketoprofen and paracetamol and Tramadol	10	(22.2)
Ofloxacin	1	(2.2)	Paracetamol only	8	(17.8)
No antibiotic	30	(66.7)	Ketoprofen and paracetamol	7	(15.6)
			Tramadol only	1	(2.2)
			No antalgic	1	(2.2)

Table 6. Temperature monitoring and clinical appearance monitoring according to the diagnostic.

	Temperature monitoring	Clinical appearance monitoring
Dental abscesses	50 (71%)	37 (52%)
Tooth decays	27 (60%)	30 (66 %)
Dental fractures	7 (58%)	6 (50%)

associated with 10 prescriptions of weak opioid analgesics and 17 prescriptions of nonopioid analgesics (Table 5).

Mouthwash and tooth decay. Among the 45 cases of decay, there were 22 prescriptions of mouthwashes (15 Chlorhexidine-Chlorobutanol and 7 Hexetidine).

Prescriptions and dental fracture

Antibiotics and dental fracture. Among the 12 dental fractures there were 4 prescriptions of antibiotics (2 prescriptions of Amoxicillin/Clavulanic acid and 2 prescriptions of Amoxicillin).

Analgesics and dental fracture. Among the 12 dental fractures there were 11 prescriptions of analgesics medication including 4 prescriptions of weak opioid analgesics and 7 prescriptions of nonopioid analgesics. NSAID was associated with one prescription of weak opioid analgesics and three prescriptions of nonopioid analgesics.

Temperature and clinical appearance monitoring

Temperature monitoring was required in 71% of abscesses, 60% of tooth decays, and 58% of dental fractures. Clinical appearance monitoring was required in 52% of abscesses, 66% of tooth decays and 50% of dental fractures (Table 6).

Digital photography

For further information, digital photography was requested in five cases of dental abscess and two

diagnoses of tooth decay, which correspond to 5% of dental-related cases.

Discussion

The proportion of dental emergencies (1.48%) compared with the total number of medical emergencies is similar to the proportion found in other studies at sea, particularly the study by Dahl in 2006 (1.46%).¹¹ However, Westlund et al. found a higher proportion of seafarers contacted the Swedish TMAS with dental emergencies: tooth-related cases comprised 3% of medical emergencies in 1997 and 2002, and 7% in 2007.¹² In comparison with general hospital emergency departments onshore, dental oral emergencies constituted between 1% and 3.8% of all emergencies.¹³

Limitations of the study

Due to the nature of the study (retrospective), some of the data was missing, including a lack of precise data for the impact of the TMAS dental intervention. We are not able to assess exactly how often the recommendations solved the problems because of the lack of follow-up consultations. However, each dental emergency case was the subject of a single call. We can assume therefore that teleconsultation with TMAS solved the problem, at least temporarily. Telemedicine may therefore be a viable option for remote screening, diagnosis and treatment planning for oral disease.¹⁴ Telemangement of dental emergencies was limited to medication, however, in most cases dental care requires specific procedures that are actually not available on board.¹⁵ Although patients are often referred to a dentist, as highlighted by several studies,^{5,16,15} we have no information regarding the proportion of patients referred to a dentist onshore. Port consultations are time-consuming, costly and often ineffective because of language barriers and limited port time to access dental care.⁵ Depending on the diagnosis and symptom control, telemangement by TMAS may enable patients to wait until they are at home to see their own dentist.⁵

There are no dentists in TMAS. TMAS physicians recorded the different categories of diagnoses in this study. These doctors are not dental specialists, so some categories might include several diagnoses. For example, the category 'Dental abscess' might include the diagnoses of oral cellulitis, periodontal abscess, etc. Likewise, the category 'Decay' might include the diagnoses of reversible pulpitis, irreversible pulpitis, pulpal necrosis, etc. The category 'Dental fracture' might include trauma as well as a loss of dental filling for example. However, health professionals (other than dentists) have the potential to screen for oral disease via remote consultation and intra-oral photographs, leading to an accurate and reliable diagnosis.¹⁷

Characteristics of seafarers

Seafarers are particularly at risk of developing oral disease and considering the complexity of managing dental emergencies at sea, regular and adequate preventive pre-screening of seafarers is really important.¹⁸ A systematic check-up by a dentist is advised but not always mandatory for professional civilian sailors, unlike military sailors in France. A full dental check-up carried out by a certified dentist and a panoramic x-ray should be a pre-requisite before boarding.

The small proportion of women (3%) affected by dental emergencies in this study can be explained by the relatively low numbers of women at sea. Indeed, in 2009 women represented only 7% of sailors in the French Merchant Navy.¹⁹ Furthermore, women more often have dental check-ups and brush their teeth more regularly than men.²⁰ Several studies show that the majority of emergency dental consultations are requested by men.^{13,21} While French seamen represent only 1% of the seamen in the world,¹⁹ the high proportion of French seamen (46%) in this study is explained by the fact that this TMAS is a French structure and so receives more calls from French ships. The high proportion of Filipino seamen is explained by the fact that Filipino seamen² represent 25% of seamen worldwide.¹⁹ The mean age (39 years) of patients in this study is close to the mean age of other studies on seafarers: 37 years for Sobotta et al.²² and 35 years for Elo.²³ There is little information in the literature on the type of vessel contacting TMAS. Most studies are interested in only one type of boat^{22,24} or do not consider this information.²⁵ Among the 186 calls for medical advice received in 2005 in Scottish coastal waters, 38% were from fishing vessels.²⁴ In the current study only 17% of calls to the French TMAS came from fishing boats, the majority of calls were from merchant marine vessels.

Management of oral emergency

A high number of dental abscesses (70 cases among 135) were reported compared with other studies (e.g. 3 cases among 130 in Dahl's study¹¹). Studies show that a non-negligible proportion of infections that occur on board are dental.^{6,26} The proportion of tooth decay (33% of dental cases in the present study) is relatively low compared with the study by Sobotta et al., which found a diagnostic of tooth decay in 85% of dental emergencies.²⁷ This difference may be caused by bias in the diagnostic categories. In 2012, 454 patients went to the Royal Hobart Hospital Emergency Department (Australia): 40.3% for toothache and tooth decay, 37.2% for dental abscesses, and 7.3% for tooth fractures.¹³ In this general hospital emergency department, the recorded diagnoses were made by medical staff not dentists. In France, in the on-call dental emergency unit of Brest University Hospital, dentists examined 335 patients between 2007 and 2008. Forty-six per cent of these emergency consultations concerned an infectious aetiology and 4% a traumatic aetiology.²¹

In our study, 79% of abscesses received an antibiotic prescription, which matches both French and international recommendations for dental infection management. In the study by Westlund et al., antibiotics were also prescribed in 79% of infection-related cases.²⁵ A prescription of Amoxicillin/Clavulanic acid was observed in 90% of antibiotic prescriptions, in keeping with the *International Medical Guide for Ships* that recommends a systematic prescription of Amoxicillin/Clavulanic acid in any incidence of dental pain.²⁸ This guide, published by the World Health Organization, provides advice for non-medical sailors in order to treat injury or disease aboard ship. This prescription of Amoxicillin/Clavulanic acid differs from the recommendations of the French medicine regulation agency (Agence Nationale de Sécurité du Médicament et des Produits de Santé, ANSM), which recommends a prescription of Amoxicillin only²⁹ (noted in 1 case out of 70). This almost systematic prescription of Amoxicillin/Clavulanic acid might be due to the specificity of the high seas (isolation, lack of healthcare workers on board) leading to a prescription of broader spectrum antibiotics.

Antibiotics were prescribed in 33% of tooth decay cases even though the ANSM does not recommend a prescription of antibiotics for decay or pulpitis.²⁹ This prescription is probably motivated by the context and because the *International Medical Guide for Ships*²⁸ recommends the prescription of antibiotics in any instance of dental pain. Anderson et al. concluded that for oral disease, general physicians are more likely to prescribe antibiotics than dentists.³⁰ However, the prescription of antibiotics in the absence of signs of infection for a

pulpal inflammation or tooth decay does not seem justified. Similar to the other categories, the classification 'tooth decay' is broad and can include different diagnoses including pulpal necrosis. For pulpal necrosis without dental care, an antibiotic might be prescribed.

The category 'dental fracture' does not specify the origin of fractures, whether this was a traumatic injury, or loss of a filling, for example. Antibiotics were prescribed in 33% of fracture cases. In the absence of clinical evidence, this prescription of antibiotics for dental trauma is at the discretion of the dentist.³¹ NSAIDs were prescribed in 15 dental abscesses out of 70. NSAIDs can possibly lead to complications in oral cellulitis.³² In geographically isolated areas a prescription of NSAIDs should be avoided if signs of infection are present, even if associated with antibiotics. Mouthwash was prescribed in 40% of dental abscesses and 49% of tooth decay. The *International Medical Guide for Ships*²⁸ recommends a mouthwash with salted, boiled water every hour for any dental pain.

Temperature monitoring was required in 71% of abscesses, 60% of tooth decay cases and 58% of dental fractures, a useful process in isolated areas to prevent complications. Clinical appearance monitoring was required in half of both abscess and dental fracture cases, a useful process to check the occurrence of complications. Digital photography was required in 5% of dental-related cases in order to help with diagnosis, to check the spread of infection and to eliminate the further diagnoses. In 2016, photographs were received for one-third of the French TMAS's consultation cases.³³ In 2011, in the Swedish TMAS, digital photographs were sent by email for 11% of cases involving seafarers.¹² The use of digital images is increasing but could be used more frequently. TMAS physicians could benefit from the use of digital photography sent by email for telehealth at sea where dentists are not available.³⁴ Digital photographs facilitate the reorganisation of information needed for telemedicine in order to refine the initial diagnosis, monitor care and if necessary request the opinion of one of the specialists, for example, at Toulouse Hospital.³³ To improve telemedicine and telecare for the management of dental emergencies at sea, video conferencing could also be developed.³⁵

Several literature reviews have confirmed that telemedicine is a viable option for dental emergency management, especially in areas with limited access to care.^{14,36,37} However, dental healthcare usually requires a dentist (decay scraping, tooth extraction, abscess incision, etc.). The average incidence of 27 medical records per year for dental emergencies at sea does not justify a dentist on board. On board, without special equipment or specifically trained healthcare workers, the ability to care for dental emergencies is limited. As shown in both

the literature⁵ and this study, the management of dental emergencies at sea boils down to drug prescription. However, drug prescription alone is rarely totally effective for relieving dental pain.¹³ Furthermore, compulsory medical supplies and on-board medical guidelines do not presently seem to be well suited to the management of dental emergencies at sea (for local anaesthetic, temporary filling, abscess draining, etc.). Simple and specific equipment for dental management (for example temporary filling material) could be added to on-board medical supplies and may help in the future.²⁶ This is already the case in ocean racing.³⁸ In addition, an up-to-date guide and more suitable recommendations concerning the management of dental emergencies at sea could be provided. Such a guide could facilitate care for dental emergencies by TMAS physicians and seafarers.

Conclusion

The incidence of dental emergencies on board civilian ships sailing at sea account for about 1.48% of medical emergencies. The three main dental emergencies for which ships call TMAS are dental abscesses, tooth decay and dental fractures. Currently the management of dental emergencies at sea is usually limited to a drug prescription. Updating the *International Medical Guide for Ships*, the addition of simple and specific on-board dental equipment and the training of seafarers in the management of dental emergencies would facilitate more effective treatment. A prospective study including telerdentistry and specifically assessing the effectiveness of TMAS in dental emergency management could be performed.

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